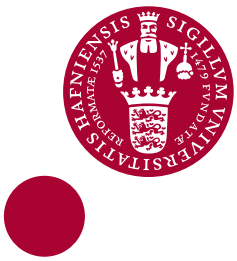

Shades of green

a social scientific view on bioeconomy in the forest sector

Kleinschmit, Daniela; Lindstad, Berit Hauger; Thorsen, Bo Jellesmark; Toppinen, Anne; Roos, Anders; Baardsen, Sjur

Published in:
Scandinavian Journal of Forest Research

DOI:
10.1080/02827581.2014.921722

Publication date:
2014

Document version
Early version, also known as pre-print

Pre-print of the paper published later as:

Kleinschmit, D., B. Lindstad, B.J. Thorsen, A. Toppinen, S. Baardsen and A. Roos, 2014: Shades of green: a social scientific view on bioeconomy in the forest sector. *Scandinavian Journal of Forest Research*, 29: 402-410

Shades of green: a social scientific view on bioeconomy in the forest sector

Daniela Kleinschmit[1*], Berit Hauger Lindstad[2], Bo Jellesmark Thorsen[3], Anne Toppinen[4], Anders Roos[1] and Sjur Baardsen[2]

[1] Department of Forest Products, Swedish University of Agricultural Sciences, Uppsala, Sweden

[2] Department of Ecology and Natural Resource Management, Norwegian University of Life Sciences, Aas, Norway

[3] Department of Food and Resource Economics, University of Copenhagen, Denmark.

[4] Department of Forest Sciences, University of Helsinki, Finland

*corresponding author: Daniela Kleinschmit, Unit of Forest Policy, Department of Forest Products, SLU, P.O. Box 7008, SE-75007 Uppsala, Sweden. E-mail: daniela.kleinschmit@slu.se

Abstract: Politics increasingly introduces initiatives supporting a shift towards a bioeconomy aiming at a society relying strongly on renewable biological sources while achieving economic growth efficiently and sustainably. However the agenda of bioeconomy comprises different "shades of green", in the sense that different actors stress different aspects of the concept, when embracing it in communication. This conceptual paper aims to present policy and socio-economic theoretical frameworks and research areas relevant for a more holistic understanding of the bioeconomy concept applied to the forest sector, and identify a core set of potential contributions from social sciences for enhancing the bioeconomy in the forest sector. The paper focuses on studies within policy analysis, economics and business administration disciplines. Thus it presents diverse disciplinary perspectives on the forest sector in a

bioeconomy. Furthermore innovation and sustainability have been identified as issues relevant to be approached across these disciplines.

Keywords: Economics, political science, business management research, future directions.

1 Introduction

Politics increasingly highlights the importance of strengthening a bioeconomy. The major aim of political bioeconomy strategies is the call for a shift towards a society relying strongly on renewable biological sources while achieving economic growth. Knowledge, innovation and sustainable management are identified as core factors contributing to achieve this aim (EU Commission 2012a). Forests and the forest sector are expected to provide a significant contribution to a bioeconomy (ibid.).

So far the majority of bioeconomy studies are within natural science and engineering perspectives, such as biotechnology or genetic engineering. However, it has been acknowledged that the road toward a bioeconomy involves economic and policy challenges, e.g. in order to implement appropriate regulations, foster information exchange, get incentives right, and support knowledge development (Najam & Selin 2011). Furthermore, innovations are needed on greener products and in developing new greener businesses. In accordance with these challenges the OECD states that social analysis is necessary in order to guide policymaking (OECD 2009). Some scholars dealing with transition management and coevolution already marked that a shift from fossil economy towards bioeconomy means a comprehensive systemic change affecting and being affected by amongst others economic, business and other social systems (Foxon 2011; Loorbach & Wijsman 2013). To gain a deeper understanding on how policies and market forces interact and shape conditions for the bioeconomy, social scientific research is required. This paper concentrates on political, economic and business administration sciences being aware that other social scientific areas as well can contribute to the understanding the conditions of the bioeconomy.

The bioeconomy concept has developed to include a great variety of agendas and ambitions implying challenges and opportunities for the forest sector to a degree that the boarders of the traditional forest sector might become blurred, although still integrated in a bioeconomy sector. However, previous reviews done on the evolving bioeconomy (e.g. McCormick & Kautto 2013) have not analyzed it from the perspective of the forest sector. Therefore this conceptual paper aims to (1) present socio-economic theoretical frameworks and research areas relevant for a more holistic understanding of the bioeconomy concept applied to the forest sector, and (2) identify a core set of potential contributions from socio-economic and policy research for enhancing the bioeconomy in the forest sector.

The paper starts with shedding light on the different perspectives inherent in the bioeconomy concept (section 2). In the third section, the paper presents selected theoretical frameworks and examples of studies within policy, economic and business administration disciplines relevant for understanding bioeconomy in the forest sector. In the fourth section, arising research questions and possible contributions for future socio-economic research are discussed before conclusions are drawn in section five.

2 The bioeconomy concept

Bioeconomy can to be delineated from the broader concept of a green economy which follows the definition of UNEP, namely one "that results in **improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities**." (UNEP, 2010). This paper focuses on the concept of bioeconomy which can be understood as part of the green economy, but emphasising various

aspects differently. In this section we want to point to the different "shades of green" covered by the bioeconomy concept rather than listing the different definitions available for the bioeconomy. An overview of definitions and political concepts of bioeconomy used in the last decade, discovering synergies and inconsistencies has been provided by Schmid et al. (2012).

There is evidence that the bioeconomy concept has become increasingly popular in the last decade (Staffas et al. 2013). The concept starts from the premises that natural resources are limited and thus need to be used efficiently. It has its roots in the discourse of ecological modernization arguing that economic growth and development can be aligned with environmental protection (Arts et al. 2010). Following the ecological modernisation discourse, the bioeconomy concept as well facilitates an enhanced role for the private sector (ibid.). The dominant paradigm of technological progress in a liberal market is mirrored in the bioeconomy concept by stressing the role of biotechnology and innovative products.

The scope of the political bioeconomy concept differs, depending on those using it. OECD and the US focus on the process converting raw material into value added products using biotechnology and life sciences (Staffas et al. 2013). The EU and some of its member states focus on an economy which is based on the use of biomass resources (ibid.), comprising "[…]biological resources from the land and sea, as well as waste, as inputs to food and feed, industrial and energy production […]" (European Commission, 2012b). Simplifying one could state that "bio" refers in the former perception to biotechnology and in the latter perception to the use of bioresources. Furthermore, the bioeconomy concept is framed in a way drawing attention to e.g.

sustainability and planetary boundaries, e.g. when embraced by green NGOs or scholars of this area (e.g. Asveld et al. 2011). We understand these different perspectives as the "shades of green" of the bioeconomy concept. This 'shadiness' of the concept has been criticized elsewhere as "the 'fetishization' of all things 'bio' " (Birch & Tyfield 2012).

The role of forests and the forest sector in the bioeconomy depends on which perception is taken. In general the bioeconomy is regarded as cross-sectoral making it relevant for actors associated with diverse sectors (Hilgartner 2007). Major forest sector stakeholders align with the concept of bioeconomy(Finnish Ministry of Agriculture and Forestry 2010; Swedish Forest Industry 2012; Forest-based Sector Technology Platform 2013) and emphasize their role in contributing to a bioeconomy. This can be regarded as an indicator that the benefits of being integral part of the bioeconomy are well perceived.

3 Policy, economic and business administration sub-fields relevant for bioeconomy in the forest sector

Because the bioeconomy concept covers a range of policy agendas in varying shades of green, it presents a large variety of demands, expectations and challenges for the forest sector. Several of these imply a call for social science contributions. In this section we outline relevant sub-fields of the three disciplines, policy science, economics and business administration as these areas can be regarded as essential to understand how policies and market forces interact and shape conditions for the

bioeconomy. The areas are linked to the general kind of research questions they may address, using examples from the literature.

3.1 Policy theories and related research

Policy analysis being part of political science builds on a multitude of theories that can be grouped into different 'families'. In the following, central research areas are described within the different theoretical families of forest policy research following Arts (2012) and examples of existing bioeconomy relevant studies are given.

Rational policy analysis characterizes a 'classical' theoretical family closely linked with classical economic theories. It highlights rational and strategic decisions taken by individuals or by a collective based on the highest benefits net of costs. Research on forest policy supports this theory by revealing benefits as the driving force for forest owners to manage their forests in a specific way (Krott 2005). These benefits are not limited to economic benefits. This may represent a challenge for the forest sector in the bioeconomy as private forest owners maximize their utility rather than their profit, implying some reduction in the delivery of biomass to the industry (cf. Krott 2012, p.39).

Institutional/Neo-institutional policy analysis is based on the assumption that behaviour of actors can be explained by the appropriateness of a certain institutional setting resulting from rules, norms and beliefs (Schlager & Ostrom 1992). These policy studies have become popular among scientists focusing on the forest sector (Kleinschmit et al. 2012). Norms, e.g. represented in form of public acceptance, have been identified as one of the key factors pushing or hindering a shift towards the

bioeconomy (Benner & Löfgren 2007), in particular concerning contested practices like genetic modification of trees (Moon Chapotin & Wolt 2013).

Advocacy Coalition Framework (ACF) is a theoretical framework popular in forest policy research focusing on coalitions between actors based on belief systems that might result in policy change through learning (Sabatier & Weible 2007). Innovation as a core element of the bioeconomy can be a result of these learning processes. Rametsteiner & Weiss (2006) identified that innovation in the forest sector is limited due to traditional coalitions of actors and limited exchange with actors facilitating learning, e.g. research institutions and policy institutions.

Critical policy analysis comprises different approaches linked by understanding that the world exists independently of our knowledge, and highlighting the role of power in general and the influence of scientists in particular (Arts, 2012). Studies based on discourse theory, revealed amongst others an increased role for markets, the private sector and voluntary regulations in (international) forest policy (e.g. Humphreys 2009), in line with the concept of bioeconomy.

Furthermore **governance studies** using different of the aforementioned theoretical approaches highlight and explain the multi-level, cross-sectoral and multiple actor characteristics of forest policy making, e.g. as adaptive co-management. However, in the forest sector strong sectoral boundaries have been identified. These result not only in limited market opportunities, but as well hinder innovation (Rametsteiner & Weiss 2006).

3.2 Economic theories and related research

Economics has evolved to a broad science with no all-encompassing definition. Classical definitions focus on the allocation of scarce resource, while the behavioural aspect is more prominent in recent definitions (Backhouse & Medema 2009). In the following five sub-fields relevant for the analysis of the bioeconomy are introduced.

Resource economics focuses on the optimal management of natural resources, as seen from a private as well as a social point of view. Classical contributions include the optimal rotation age problem (Faustmann 1849), the extraction of non-renewable resources (Hotelling 1931), and extensions acknowledging forest externalities (Hartman 1976). This latter aspect has received enormous attention with the focus on carbon sequestration (van Kooten & Binkley 1995; Stavins 1999).

Very few peer reviewed articles dealing with economic aspects of natural resource uses or link their analyses to the bioeconomy concept. Most are assessments of specific technologies, e.g. Low and Isserman (2009), O'Keefe et al. (2012), or slightly broader multi-criteria assessments of competing technology designs (Sultana & Kumar 2012).

Environmental valuation is concerned with estimating the values of externalities. In the greener shades of the wide bioeconomy fan of agendas, we find policy goals like management of natural ecosystems for sustained ecosystem services and protection of biodiversity (Kumar 2010; Bateman et al. 2013). Knowledge about the values of forest ecosystem services and biodiversity protection is fundamental to assess policy measures. Numerous applications can be found in forest economics targeting recreational use aspects (e.g. Zandersen et al. 2007; Lindhjem 2007), as well as biodiversity protection, amenity values, water protection (Campbell et al. 2013) and many other environmental issues.

Public Economics is concerned with aspects of market failures, including those arising from externalities, welfare effects (cost-benefit analysis), equity and distributional aspects and policy design. In relation to forestry and the bioeconomy, the aspects of regulation targeting externalities are of clear relevance. So are public policies to enhance innovation and knowledge on new technologies. The literature contains many examples of analyses investigating policy designs targeting forest activities, and options for designing and applying market-based instruments for optimal provision of ecosystem services (Engel et al. 2008), including the role of forests in climate change mitigation (see e.g. van Kooten et al. 1995; Delacote et al. 2013).

Behavioural economics attempts to merge insights from in particular psychology (e.g. Kahneman & Tversky 1979) into the neoclassic economic theory to ameliorate shortcomings of the latter in explaining human behaviour. In the forest sciences, related studies exist investigating forest owner decision making, motivations and objectives. An early study is Kuuluvainen et al. (1996), but many others exist (Lönnstedt 1997; Boon et al. 2004; Størdal et al. 2007; Broch & Vedel 2012; Blennow et al. 2013). The understanding of forest owner motivations and decision making is crucial for appropriate policy design.

Ecological economics is a trans-disciplinary subfield with a strong focus upon the natural systems, capital, dynamics and boundaries and the implications of these for sustainable economic uses and development. A hallmark publication in this field (Costanza et al. 1997) has been quite influential in paving the way for the current focus on ecosystem services (de Groot et al. 2002), and the PES agenda (Engel et al. 2008). Concerns about planetary boundaries and sustainable global growth and the

bioeconomy concept itself may be inspired by aspects of ecological economics (Lehtonen 2004), but is also likely to be challenged from this field.

3.3 Business administration theories and related research

From the business administration point of view, four main research areas are identified as relevant in the context of the forest sector in a bioeconomy. First, the central role of business has extended from the traditional economic actor to a political and social actor via concept of **Corporate Social Responsibility** (CSR/CR). Corporate social responsibility is often used in conjunction with other terms such as 'corporate responsibility', 'corporate sustainability' or 'corporate citizenship', , or as a synonym of other concepts such as triple-bottom line (economic, environmental, and social) and the three Ps (profits, planet, and people). According to dominant management theory behind CSR, a company is responsible not only for its shareholders, but also for a wide range of other stakeholder groups, including the natural environment (Freeman 1984, Hart 1995). In Crifo and Forget (2014), forces driving CSR are identified to be based on three types of market imperfections: the existence of externalities and public goods, consumer heterogeneity and imperfect market competition, and existence of imperfect contracts with key stakeholders. Empirical research under CSR in forest sector has gained momentum in recent decades, focusing on adoption of CSR practices, standardized sustainability reporting and defining what constitutes eco-efficiency (see e.g. Mikkilä and Toppinen 2008, Vidal & Kozak 2008, Koskela & Vehmas 2012).

Second, studies on ***green customer practices*** (green consumerism for end-consumers and green purchasing in business to business relations) could have an impact on the

development toward a bioeconomy, although clear cut answers cannot always be expected on criteria, means and ends (Moisander 2007). Several empirical studies have analyzed customer preferences for eco-labeled, or certified, forest products. These segmentation or willingness to pay-studies have delivered ambiguous results, based on "socially desired responses" and simplistic views customer behavior (Forsyth et al. 1999, Cai & Aguilar 2013). However, further enquiry has turned the focus to the role of values, and experiences (Hansmann et al. 2006) information content of eco-labels (Aguilar & Cai 2010; Heikkonen 2012). It is a paradox that, despite thin evidence on its effect on customer demand, green marketing, and eco-labeling are still being applied, and even growing.

Third, **sustainable supply chain management** (SSCM) integrating supply chain profitability and sustainability (Chopra & Meindl 2013; Srivastava 2007) apply management science with environmental research. The field is prompted by various regulations and an insight that reduced environmental impact, efficiency gains and market success often are compatible goals. Studies to date focus on management tools, and exchanges between actors in the supply chain (von Geibler et al. 2010). SSCM has also been applied for sections of forest supply chains (Tikina et al. 2008; Räty et al. 2012). Life Cycle Assessment (LCA) approaches provide input for the mapping of environmental effects and sustainable operation of forest-based supply chains (Upton et al. 2008; Lindner et al. 2010). Combining LCA procedures with economic analyses, Dwivedi et al. (2012) found that the internalization of the value of carbon balances could increase the land expectation value of forest land.

Fourth, **green innovations** (or eco-innovations), driven by technology push (R & D) or market pull, are aiming at reducing environmental impacts (e.g. Rennings 2000). However, limited interest is shown towards green innovations (e.g. Hansen et al. 2006; Hansen 2010), which is mainly occurring in the Nordic pulp and paper industry as incremental process innovations (Rushton 2008). Studies identify factors limiting innovation, e.g. available resources and work-place culture (Stendahl & Roos 2008), the small size of operators (Kubeczko et al. 2006) and limited changes in market demand (Kivimaa & Kautto 2010). In addition, some EU policies, such as the Lead Market Initiative (LMI), do not even include traditional volume-based forest products (pulp, paper, wood) (Toppinen & Siljama 2011). According to Hetemäki (2010) diffusion of forest biorefinery technology is the most important concept towards the bioeconomy, but forest industry's low willingness to take investment risks has been perceived as a barrier for diffusion (Näyhä & Pesonen 2012). The potential impact through material substitution in e.g. wooden multi-story construction is another important avenue for progressing green innovations. This is, however, according to Brege et al. (2013) calling for a fundamental change of business models in the construction industry value-chains.

4 Missing shades of green: possible contributions of social science

This section builds on the theories and existing research introduced in section 3, and aims to enhance future contributions from social sciences in the developments of the forest sector in the emerging bioeconomy. It might be used as a starting point for discussing a research agenda on bioeconomy in the forest sector.

4.1 Possible policy research contributions

Policy studies deal only selectively with very specific problems of the forest sector in a bioeconomy (see some examples in section 3). However, the political demand for a shift towards a bioeconomy deserves a political scientific investigation in the design of the political framework supporting this shift. In particular governance research offers to understand and explain the problems at hand, long-term societal trends and needs across sectors and across multiple actors. It approaches the creation and exploitation of opportunities by systematically paying attention to institutional settings (Kooiman & Bavinck 2005). The identification of opportunities for vertical and horizontal integration of forest and bioeconomy policies is central to support effective and efficient policies and can be approached by governance research. Under the umbrella of governance research the different theoretical approaches can contribute to shed light on specific policy problems and situations of the forest sector in the bioeconomy. The identification of options of cross-sectoral coalitions supporting innovation in and across the forest sector can be supported amongst others by the ACF. Research on vertical integration can contribute to identify those institutional bodies and instruments able to drive a shift towards a bioeconomy.

Applying the rational choice approach can support identifying those actors benefiting from a shift towards a bioeconomy and those with conflicting interests. This might serve as a basis for balancing different demands on forests, minimizing trade-offs and conflicts. Critical policy analysis can be used to reconstruct prevailing ideas, concepts and narratives in the discussion on bioeconomy. Starting from this it can reveal power situations that are reproduced in discourses and the role of research and researchers in a bioeconomy. In post-structuralism scientific discourses, the institutions producing

them are central in producing “truth” and thus can be regarded as co-creators of the future.

The opportunity for social innovation in a bioeconomy can be addressed by different approaches, the (neo-) institutional approach, e.g. under the umbrella of governance research but as well by applying rational choice approaches asking for the individual contribution to social innovation.

4.2 Challenges with a clear role for economic research

R&D in new technology is a core focus of the bioeconomy. R&D-efforts are likely to be sub-optimal due to problems of intellectual property rights protection and losses. A classic question thus arises: How much should the public support and subsidize innovation and diffusion in the biobased sectors – and how much should be handled by markets themselves?

New advanced technologies may have profound impacts on markets for forest products. How will this affect forest management? In particular the development of the biorefinery concept may fundamentally shift the understanding of wood quality.

Climate policies and sector development are linked and forest products prices are heavily influenced by the European Trading Scheme price on carbon, as it induces an increase in the use of biomass in the energy sector. Thus, flows, but not stocks of carbon in the forest have value, and still incentives need balancing. Many questions require research, e.g. how far into the solid wood sector incentives should be carried. How should the issue of joint production (production processes which by nature results in several simultaneous outputs, e.g. timber produced along side bioenergy and biodiversity protection) be handled? What are equilibrium effects on energy markets

and timber markets, and what are climate effects? What about indirect land use changes?

Biodiversity protection and non-marketed forest ecosystem services will remain in focus as the pursuit of more efficient, advanced valuable uses of biobased products is likely to have significant environmental impacts. It is of paramount importance that these are included in assessments of technologies and forest management methods, to ensure that progress is indeed welfare enhancing and gains in marketed values not outweighed by non-marketed environmental impacts. A particular research challenge here is a better understanding of international cross-boundary transcendence of environmental benefits as well as costs.

4.3 Key future challenges from a business administration research perspective

The majority of previous studies on sustainability strategies, practices and implementation of CSR in the forest industry have focused on large companies. Given the vast number of small and medium sized companies, and the recognized small scale potential in the de-centralized bioeconomy (e.g. SITRA 2011), better understanding is needed for supporting the *implementation of CSR among SMEs* in both the traditional forest industries and in production of emerging new bio-based products. Also analyses of outcomes from implementing CSR in the form of "frontrunner practices", "improved business case", or as any other relevant economic or social benefits would be fruitful. Addressing the question how 'greenness' can be used as a competitive advantage for a firm's overall (or marketing) strategy is also warranted (Li and Toppinen 2011).

The use of LCA based approaches in research is currently broadening towards the use of *social life-cycle assessment* (SLCA) and *environmental life-cycle costing* (ELCC).

Methodologically the approaches could move on towards more rigorous estimations of joint sustainability/economic aspects of green supply chains and on prescriptive analyses. More innovative studies of how consumer choices are developed dynamically and how they depend on experiences, values, and norms is needed, as is research that explicitly addresses the consumers' roles for a bioeconomy (regarding new products such as nano-products, composites, bio-chemicals and bio-fuels). There could be also "blind spots" at the intersection of public policies and private sector business, where the development potential of small scale, local level business opportunities are yet neglected. Since innovations for the forest based economy range from incremental improvements for cost/environmental efficiency gains and share gains in existing markets, to more radical innovations for emerging 'new' markets, new skills and resources are required. Finally, an area which warrants more research, is cross-industry collaborations over innovations, e.g. with the automotive industry.

5 Conclusion: Hot spots of future policy and economic research on bioeconomy

Politics increasingly introduce initiatives supporting a shift towards a bioeconomy aiming at a society relying strongly on renewable biological sources while achieving sustainable economic growth efficiently. Supporting these initiatives requires disciplinary interaction and integrated approaches of social sciences. Focusing on policy research, economics and business administration, different theoretical frameworks and research areas relevant for understanding the bioeconomy concept applied to the forest sector as well as a core set of potential contributions have been presented in this paper (summarized in table 1).

The different disciplines of social sciences contribute to a better understanding and explanation of a great diversity of factors driving and hindering a shift towards bioeconomy starting from specific disciplinary perspectives. Some issues with high relevance for the forest sector in a bioeconomy attract greater attention across all three disciplines. Two of these cross-disciplinary issues identified in this paper are innovation and (the management of) sustainability at global, national and local levels.

Innovation becomes substantial in a bioeconomy as new technologies and products are aimed for. It demands a specific policy setting allowing learning across sectors, balancing public support, technology push and market pull, e.g. by environmental standardization and labeling or via green public procurement. Integrated forest and environmental management becomes relevant in the bioeconomy when striving not only for efficient but at the same time sustainable resource use and environmental protection taking into account the provision of diverse ecosystem services from forests. This integration might be accompanied by diminishing the traditionally strong actor-coalitions of the forest sector. Identifying political and economic trade-offs and conflicting interests of stakeholders in using forests, assessing the economic values of forest ecosystem services and biodiversity protection and providing incentives for CSR and green consumerism are core challenges in the context of integrated forest management in the bioeconomy. One example of political and economic trade-offs is the choice between short-rotation forests with fast growing species where biodiversity protection and increased productivity interests might be in conflict.

Innovation and sustainability are examples of cross disciplinary research issues referring to different “shades of green” in the concept of bioeconomy. Biotechnology

driven perspectives, highlighting innovation, deserve different theoretical and analytical starting points and approaches than do perspectives focusing on the sustainable use of biological resources or the pursuit of the right provision of ecosystem services. However, all shades of green and the related objectives, interests and challenges must be considered in the future research on the role and potentials of the forest sector in the bioeconomy; the aim being to provide a holistic understanding of these potentials, and to avoid negligence of others.

References:

Aguilar, F. X., Cai, Z. 2010. Conjoint effect of environmental labeling, disclosure of forest of origin and price on consumer preferences for wood products in the US and UK. Ecological Economics 70(2): 308-316.

Arts, B. 2012. Forest Policy Analysis and Theory Use: Overview and trends. Forest policy and Economics *16*: *7-13.*

Arts, B., Appelstrand, M, Kleinschmit, D., Pülzl, H., Visseren-Hamakers, I., Eba'a Atyi, R., Enters, T., McGinley, K., Yasmi, Y. 2010. Discourses, actors and instruments in international forest governance. In: Rayner, J., Buck, A., Katila, P. (eds): Embracing complexity: meeting the challenges of international forest governance. IUFRO World Series vol 28. Vienna: 57-73.

Asveld, L., van Est, R., Stemerding, D. (eds.). 2011. Getting to the core of the bio-economy: A perspective on the sustainable promise of biomass. The Hague: Rathenau Instituut.

Backhouse, R.E., Medema, S.G. 2009. Retrospectives: On the Definition of Economics. Journal of Economic Perspectives 23: 221-233.

Bateman, I.J., Harwood, A.R., Mace, G.M., Watson, R.T., Abson, D.J. , Andrews, B. , Binner, A., Crowe, A., Day, B.H., Dugdale, S., Fezzi, C., Foden, J., Hadley,D., Haines-Young,R., Hulme, M., Kontoleon, A., Lovett, A.A., Munday,P., Pascual, U., Paterson, J.,Perino, G., Sen, A., Siriwardena,G., van Soest, D., M. Termansen, M. 2013. Bringing Ecosystem Services into Economic Decision-Making: Land Use in the United Kingdom. Science 341: 45-50.

Benner, M., Löfgren, H. 2007. The Bioeconomy and the Competition State: Transcending the Dichotomy between Coordinated and Liberal Market Economies. New Political Science 29(1): 77-95.

Birch, K. , Tyfield, D. 2012. Theorizing the Bioeconmy: Biovalue, Biocapital, Bioeconomics or … What? Science Technology Human Values 38 (3): 299-327.

Boon, T.E., Meilby, H., Thorsen, B.J. 2004. An empirically based typology of forest owners in Denmark – improving the communication between authorities and owners, Scandinavian Journal of Forest Research 19 (suppl. 4): 45-55.

Brege, S., Stehn, L., Nord, T. 2013. Business models in industrialed building of multi-storey houses. In press, Construction Management and Economics.

Broch, S. W., Vedel, S.E. 2012. Using choice experiments to investigate the policy relevance of heterogeneity in farmer agri-environmental contract preferences. Environmental and Resource Economics 51(4): 561-581.

Cai, Z., Aguilar, F. X. 2013. Meta-analysis of consumer's willingness-to-pay premiums for certified wood products. Journal of Forest Economics 19(1): 15-31.

Campbell, D., Vedel, S.E., Thorsen, B.J., Jacobsen, J.B. 2013. Heterogeneity in the demand for recreational access – distributional aspects. Journal of Environmental Planning and Management. [Forthcoming] http://www.tandfonline.com/doi/full/10.1080/09640568.2013.793173

Chopra, S., Meindl, P. 2013. 5th ed. Supply Chain Management - Strategy, Planning, and Operation. Essex: Pearson Education.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg,K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M. 1997. The value of the world's ecosystem services and natural capital. Nature 387: 253-260.

Crifo, P. , Forget, V. 2014. The economics of corporate social responsibility: A firm-level perspective survey. Forthcoming in Journal of Economic Surveys. doi: 10.1111/joes.12055

de Groot, R.S.,. Wilson, M.A., Boumans, R.M.J. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. Ecological Economics 41: 393–408.

Delacote, P., Palmer, C., Bakkegaard, R.K., Thorsen, B.J. 2013. Unveiling information on opportunity costs in REDD: who obtains the surplus? Resource and Energy Economics 29 [Forthcoming].

Dwivedi, P., Bailis, R., Stainback, A., Carter, D. R. 2012. Impact of payments for carbon sequestered in wood products and avoided carbon emissions on the profitability of NIPF landowners in the US South. Ecological Economics 78: 63-69.

Engel, S., Pagiola, S., Wunder, S. 2008. Designing payments for environmental services in theory and practice: An overview of the issues. Ecological Economics 65: 663-674.

EU Commission. 2012a. Innovating for Sustainable Growth: A Bioeconomy for Europe. Communication from the Commission to the European Parliament, the Council, the European economic and Social Committee and the Committee of the regions, Brussels 13.2.2013.

EU Commission. 2012b. Commission Adopts its Strategy for a Sustainable Bioeconomy to Ensure Smart Growth in Europe. Press release, 13 February, Memo/12/97. http://ec.europa.eu/research/bioeconomy/news-events/news/20120213_en.htm

Faustmann, M. 1849. Calculation of the value which forest land and immature stands possess for forestry. Journal of Forest Economics 1: 7-44 [1995].

Finnish Ministry of Agriculture and Forestry. 2010. Finland's National Forest Programme 2015: Turning the Finnish forest sector into a responsible pioneer in bioeconomy.

Forest-based Sector Technology Platform. 2013. Horizons - Vision 2030 - for the European Forest-based Sector. Brussels.

Forsyth K, Haley D, Kozak RA. 1999. Will consumers pay more for certified wood products? Journal of Forestry 97: 18-22.

Foxxon, T. 2011. A coevolutionary framework for analyzing a transition to a sustainable low carbon economy. Ecological Economics 70: 2258-2267.

Freeman, E. 1984. Strategic management: A stakeholder approach. Boston: Pitman.

Hansen, E. 2010. The role of innovation in the forest products industry. Journal of Forestry, October/November: 348-352.

Hansen, E., Korhonen, S., Rametsteiner, E. , Shook, S. 2006. Current state of knowledge: Innovation research in the global forest sector. Journal of Forest Products Business Research 3(4): 1-27.

Hansmann, R., Koellner, T., Scholz, R. W. 2006. Influence of consumers' socioecological and economic orientations on preferences for wood products with sustainability labels. Forest Policy and Economics 8(3): 239-250.Hart, S. L. 1995. A natural-resource-based view of the firm. Academy of Management Review 20(4): 986-1014.

Hartman, R. 1976. The harvesting decision when a standing forest has value. Economic Inquiry 14: 52-58.

Heikkonen, H-L. 2012. Developing Guidelines for an Ideal Eco- label for Wood and Paper Products in the U.S. Master's Thesis for the examination of Master of Science (Agr. & For.) Forest Economics. Helsinki University.

Hetemäki, L. 2010. Forest biorefinery: an example of policy driven technology. In: Mery, G., Katila, P., Galloway, G., Alfaro, R.I., Kanninen, M., Lobovikov, M. and Varjo, J. (eds.). IUFRO World Series Volume 25. Vienna: 160-161. ISBN 978-3-901347-93-1

Hilgartner, S. 2007. Making the Bioeconomy measurable: politics and an emerging anticipatory machinery. Book Forum: 382- 386.

Hotelling, H. 1931. The economics of exhaustaible resources. Journal of Political Economy 39: 137-175.

Humphreys, D. 2009. Discourse as ideology: Neoliberalism and the limits of international forest policy. Forest Policy and Economics 11(5-6): 319-325.

Kahneman, D., Tversky, A. 1979. Prospect Theory: An Analysis of Decision under Risk. Econometrica 47 (2): 263–291.

Kivimaa, P., Kautto, P. 2010. Making or breaking environmental innovation? Technological change and innovation markets in the pulp and paper industry. Management Research Review 33(4): 289-305.

Kleinschmit, D., Ingemarson, F., Holmgren, S. 2012. Research on Forest Policy in Sweden. Scandinavian Journal of Forest Research 27(2): 120 – 129.

Kooiman, J., Bavinck, M. 2005. The governance perspective. In: Kooiman, J., Bavinck, m., Jentoft, S. Pullin, R. (eds) Fish for life. Interactive governance for Fisheries Mare Publication Series 3, Amsterdam Univ. Press, Amsterdam, 11-24.

Kumar, P. 2010. The Economics of ecosystems and biodiversity: Ecological and economic foundations. London, Hardback.

Loorbach, D., Wijsman, K. 2013. Business transition management: exploring a new role for business in sustainability transitions. Journal of Cleaner Production 45: 20-28.

Lönnstedt, L. 1997. Non-industrial private forest owners' decision process: A qualitative study about goals, time perspective, opportunities and alternatives. Scandinavian Journal of Forest Research 12(3): 302-310.

Van Kooten, G.C., Binkley, C.S., Delcourt, G. 1995. Effect of Carbon Taxes and Subsidies on Optimal Forest Rotation Age and Supply of Carbon Services. American Journal of Agricultural Economics 77: 365-374.

Koskela, M., Vehmas, H. 2012. Defining Eco-efficiency: A Case Study on the Finnish Forest Industry. Business strategy and the environment 21(8): 546-566.

Krott, M . 2005. Forest Policy Analysis. Springer, Dordrecht.

Krott, M. 2012. Value and risks of the use of analytical theory in science for forest policy. Forest Policy and Economics 16: 35-42.

Kubeczko, K., Rametsteiner, E., Weiss, G. 2006. The role of sectoral and regional innovation systems in supporting innovations in forestry. Forest Policy and Economics 8: 704-715.

Kuuluvainen, J., Karppinen, H., Ovaskainen, V. 1996. Landowner Objectives and Nonindustrial Private Timber Supply. Forest Science 42: 300-309.

Lehtonen, M. 2004. The environmental - social interface of sustainable development capabilities, social capital, institutions. Ecological Economics 49: 199-214.

Li, N., Toppinen, A. 2011. Corporate responsibility and sustainable competitive advantage in the forest-based industry: complementary or conflicting goals? Forest Policy and Economics 13: 113-123.

Lindhjem, H. 2007. 20 years of stated preference valuation of non-timber benefits from Fennoscandian forests: A meta-analysis. Journal of Forest Economics 12: 251-277.

Lindner, M., Suominen, T., Palosuo, T., Garcia-Gonzalo, J., Verweij, P., Zudin, S., Paivinen, R. 2010. ToSIA-A tool for sustainability impact assessment of forest-wood-chains. Ecological Modelling, 221(18): 2197-2205.

Low, S.A., Isserman, A.M. 2009. Ethanol and the Local Economy : Industry Trends, Location Factors, Economic Impacts, and Risks. Economic Development Quarterly 23: 71-88.

McCormick, K., Kautto, N. 2013. The Bioeconomy in Europe: An Overview. Sustainability 5: 2589-2608.

Mikkilä, M. , Toppinen, A. 2008. Corporate responsibility reporting by large pulp and paper companies. Forest Policy and Economics 10: 500-506.

Moisander, J. 2007. Motivational complexity of green consumerism. International Journal of Consumer Studies 4: 404–409.

Moon Chapotin, S., Wolt, J.D. 2013. Genetically modified crops for the bioeconomy: meeting public and regulatory expectations. In: Transgenic. Res. Doi10.1007/s11248-007-9122-y.

Najam, A., Selin, H. 2011. Institutions for a Green Economy. Review of Policy Research 28 (5): 451-457.

Näyhä, A., Pesonen, H. 2012. Diffusion of forest biorefineries in Scandinavia and North America. Technological Forecasting and Social Change 79*(6)*, *1111-1120.*

OECD. 2009. The Bioeconomy to 2030: Designing a Policy Agenda.

O'Keefe S., R., Schulte, P.O., Sanders, J.P.M, Struik, P.C. 2012. II Economic assessment for first generation green biorefinery (GBR): Scenarios for an Irish GBR

blueprint. Biomass and Bioenergy 41: 1-13.Rametsteiner, E., Weiss, G. 2006. Innovation and innovation policy in forestry: Linking innovation process with systems models, Forest Policy and Economics 8(7): 691-703.

Rennings, K. 2000. Re-defining innovations – ecoinnovation research and the contribution from ecological economics. Ecological Economics 39: 319-332.

Rushton, M. 2008. Nordic innovation: innovations in pulp and paper is alive and kicking and living in the Nordic countries. Pulp and Paper International. May 2008: 15-19.

Räty, T., Lindqvist, D., Nuutinen, T., Nyrud, A.Q., Perttula, S., Riala, M., Roos, A., Tellnes, L.G.F., Toppinen, A., Wang, L. 2012. Communicating the Environmental Performance of Wood Products. Working Papers of the Finnish Forest Research Institute 230, Vantaa, Finland.

Sabatier, P., Weible, C. 2007. The advocacy coalition: Innovations and clarifications. Theories of the policy process 2: 189-220.

Schlager, E., Ostrom, E. 1992. Property-Rights Regimes and Natural Resources: A Conceptual Analysis. Land Economics 68(3): 249-262.

Schmid, O., Padel, S., Levidw, L. 2012. The bioeconomy concept and knowledge base in a public goods and farmer perspective. In: Bio-based and Applied Economies 1(1): 47-63.

SITRA. 2011. Sustainable bioeconomy: potential, challenges and opportunities in Finland. SITRA studies 51. Available from: http://www.sitra.fi/julkaisut/Selvityksi%C3%A4-sarja/Selvityksi%C3%A4%2051.pdf

Srivastava, S. K. 2007. Green Supply-Chain Management: A State-of-the-Art Literature Review. International Journal of Management Reviews 9(1): 53-80.

Staffas, L., Gustavsson, M., McCormick, K. 2013. Strategies and Policies for the Bioeconmy and Bio-based economy: An Analysis of Official National approaches. Sustainability 5: 2751-2769.

Stavins, R.N. 1999. The Costs of Carbon Sequestration: A Revealed-Preference Approach. American Economics Review 89: 994-1009.

Stendahl, M., Roos, A. 2008. Antecedents and barriers to product innovation – a comparison between innovating and non-innovating strategic business units in the wood industry. Silva Fennica 42(4): 659-684.

Størdal, S., Lien, G., Baardsen, S. 2008. Analyzing determinants of forest owners' decision-making using a sample selection framework. Journal of Forest Economics 14(3): 159-176.

Sultana, A., Kumar, A. 2012. Ranking of biomass pellets by integration of economic, environmental and technical factors. Biomass and Bioenergy 39: 344-355.

Swedish Forest Industry. 2012. The Forest Industry – The Driver for a Sustainable Bioeconomy. Stockholm.

Tikina, A., Kozak, R., Larson, B. 2008. What factors influence obtaining forest certification in the U.S. Pacific Northwest. Forest Policy and Economics 10(4):240-247.

Toppinen, A., Siljama, M. 2011. Challenges and opportunities embedded in the European Union Lead Market Initiative: case bio-based products. Journal of Business Chemistry 8(2): 65-74.

Upton, B., Miner, R., Spinney, M., Heath, L. S. 2008. The greenhouse gas and energy impacts of using wood instead of alternatives in residential construction in the United States. Biomass & Bioenergy 32(1): 1-10.

Vidal, N. G., Kozak, R. A. 2008. Corporate responsibility practices in the forestry sector: Definitions and the role of context. The Journal of Corporate Citizenship 31,: 49-59.

von Geibler J.,Kristof K., Bienge K. 2010. Sustainability assessment of entire forest value chains: Integrating stakeholder perspectives and indicators in decision support tools. Ecological Modelling 221(18): 2206–2214.

Zandersen, M., Termansen, M., Jensen, F.S. 2007. Evaluating approaches to predict recreation values of new forest sites. Journal of Forest Economics 13: 103-125.